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THE NORWEGIAN NORTH ATLANTIC EXPEDITION—CRUSTACEA

The Norwegian North Atlantic Expedition, 1876-78. *Zoology*. XIV. *Crustacea*, IA. and IB. By G. O. Sars. 4to, pp. 280, with 21 Plates and a Map. (Christiania, 1885; London: Sampson Low and Co.)

NO better evidence can be adduced of the growing influence exercised by the cultivation of natural science than in the more ready tendency displayed by the Governments of various countries to promote expeditions for scientific purposes, and a greater willingness to furnish the necessary means for the publication of the results in a satisfactory manner.

Nor can we fail to look back with a feeling of pride to the work accomplished by our own early naturalists, from the days of Banks and Solander (1768-77) to the voyage of the *Beagle* (1844-46), which the "Journal" and "Observations" of Charles Darwin have for ever rendered famous; and down to the recent magnificent results of the *Challenger* Expedition, which its grand publications are rapidly unfolding to us.

The prospectus of the "Norwegian North Atlantic Expedition" was announced in NATURE, June 2, 1881 (p. 108), and the memoir on the *Gephyrœa* by Danielsson and Koren was noticed September 29, 1881 (p. 506).

The present memoir by Prof. G. O. Sars, on the Crustacea, occupies two quarto parts, illustrated by upwards of 600 figures drawn by the author himself from the actual specimens by means of the camera lucida, "thus affording a sufficient guarantee for their accuracy."

One cannot fail to be struck by the results obtained by the author in so comparatively limited an area, over part of which, at least, other naturalists must have already worked. The map embraces the ocean from the North of Scotland to Spitzbergen, and from Norway to Iceland and Greenland; or from 55° to 80° north latitude, and from 40° east to 25° west longitude.

"To avoid repetition in stating localities," writes Prof. Sars, "I have given a list of all the stations at which the dredge or the trawl was used, along with the date, position of the vessel, depth, bottom-temperature, nature of the bottom, and character of the apparatus. With but very few exceptions crustaceans were obtained at all these stations. Moreover, pelagic forms were collected with the surface-net at many other stations not included in the list. At the coast stations enumerated in conclusion, a smaller dredge was made use of, either from a boat, or from the ship when lying at anchor.

"The stations enumerated in the list have all been accurately set off on the map in which the curves of depth for 500, 1000, 1500, and 2000 fathoms are drawn as dotted lines. In the map will also be found a more strongly-marked curve, indicating the boundary-line between the cold and temperate areas, determined from the observed bottom-temperatures. This curve also forms the natural limit of the ocean valley—reaching 2000 fathoms in depth, and "filled at the bottom with ice-cold water—which shelves from the Polar Sea to the tract between Norway and Iceland, and, in the form of a narrow wedge, terminates in the so-called 'Færœ-Shetland Channel,' where it is cut off by a narrow transverse ridge from the great depths of the Atlantic" (p. 2).

Of the list of results of work performed at the eighty-six stations, either by means of the dredge, the trawl, or with "swabs," sixty give a bottom temperature of from 0° C. to 2° C. only; the highest reading being 7° C., in 237 fathoms close to the coast of Norway; whilst the average temperature at the bottom is only $2^{\circ}{\cdot}3$ C., or 3° above freezing-point.

The deepest dredging recorded in Sars' list is 1861 fathoms, with a bottom-temperature of $1^{\circ}{\cdot}2$ C.; but at p. 159 he mentions that *Harpinia abyssi* was obtained from a depth of 2215 fathoms.

In treating of the crustacean fauna of this region Prof. Sars has not included forms previously established as belonging to the Norwegian *littoral* fauna. Such forms will be fully treated of elsewhere, in a work on the Crustacea of Norway, to be shortly executed by the author.

Some idea may be formed of the extreme Arctic facies presented by the Crustacea inhabiting the depths of this cold-water area of the North Atlantic by noticing the relative proportions of species appertaining to each order recorded by Sars.

Thus of the BRACHYURA 1 species only is recorded (*Scyramathia Carpenteri*, Norman) from 220 fathoms; a form described and figured in Sir Wyville Thomson's "Depths of the Sea" (p. 175). From the slight development of the eyes and their light-coloured pigment it was probably blind, as is the case commonly with the crustacea from great depths.

Of the ANOMOURA only 1 species (*Eupagurus tricarinatus*, Norman) was taken in about 98 fathoms.

Four species of CARIDEA are described, the largest of these, *Sclerocrangon salebrosus* (Owen), appears to be widely distributed in the northern seas, ranging from 100 to 459 fathoms; but off the coast of Kamschatka, according to Tilesius, it is found abundantly in shallower water, and serves as an article of food to the natives. It ranges from Norway to Spitzbergen (p. 25).

Of the two species of *Bythocaris*, *B. leucopis* G. O. Sars, and *B. Payeri*, Heller, it is interesting to notice that the young of this Caridian do not pass through the usual post-embryonic metamorphosis, or larval stage, but on quitting the remarkably large ova, they are seen to be provided with the full number of appendages observed in the parent. All the species are true deep-sea forms (1110 fathoms!), the eyes being unusually small and imperfect.

The next form, *Hymenodora glacialis*, has legs, as in the Schizopods, with a well-developed natatory branch (exopodite) attached to the outer side of the second joint The eyes are small and imperfectly developed. It would seem to lead a semi-pelagic life, but it was taken at a depth varying from 452 to 1862 fathoms in the cold area.

Of the Schizopoda five species of "opossum shrimps," *Mysidæ*, were taken: *Erythrops gracilis* in from 263 to 498 fathoms, and *Pseudomysis abyssi*, Sars, from 1110 to 1280 fathoms! *Boreomysis nobilis*, 6 mm. long, was taken off the north-west coast of Spitzbergen, 80° N. lat. in 450 fathoms. The most remarkable of these deep-sea *Mysidæ* is the *Boreomysis scyphops*. "The eyes in this species are remarkable alike in character and form, their outer surface being, instead of convex, considerably hollowed, which gives them a well-nigh calyciform appearance. They are attached comparatively close together, in a vertical position, with the convex surface turning in and the concave out! Of any specific ocular pigment, or indeed of any visual elements whatsoever, no trace could be detected in the recently-taken specimens, and subsequent examination fully confirmed the absolute want of such" (p. 57).

One species of *Cumaceæ*, *Diastylis nodosa*, was obtained in 125 fathoms at Ice Sound, Spitzbergen. It has no trace of eyes, the ocular tract being *quite flat*, nor can any pigment or other visual element be seen (p. 63).

Of the ISOPODA 18 species are recorded, including members of the families *Apseudidæ*, *Tanaidæ*, *Anceidæ*, and *Arcturidæ*.

Sphyrapus serratus, Sars, is one of the most remarkable of these, both in the form of its body, of which 13 somites can be seen, and 19 paired appendages (Plate 21). The first pair of legs springing from the posterior part of the cephalic segment, are like the chelipeds in more highly-developed Crustaceans (Decapods), exceedingly powerful prehensile organs. The second pair of legs are as long as the entire body, and are flattened and armed with powerful spines, as if intended to serve as fossorial organs. Five pairs of slender walking appendages follow, succeeded by five pairs of biramous swimming-feet and a pair of long multiarticulate caudal appendages, also branched. The whole appearance of this creature is most remarkable, but it has a strong resemblance to *Apseudes*.

Sphyrapus serratus occurs in the open sea between Norway and Iceland, and also west of Spitzbergen, varying in depth from 1163 to 1333 fathoms, and ranging from the 63rd to the 78th parallel of latitude. Eyes, in a strict sense, are entirely wanting; no trace of visual elements whatever could be detected (p. 68). Of the *Tanaidæ*, three species, belonging to as many genera, were taken; all in deep water and all blind (Plate 7). The colour of these forms, as a rule, is a uniform white.

Not least remarkable among the Isopoda are the *Anceidæ* (Plate 8), most insect-looking of all the Crustacea! "The so-called mandibles (Fig. 6), which, however, as pointed out by Prof. Dohrn, both as regards their position relative to the buccal orifice and their general development, can scarcely be held to be homologous with the mandibles in other Crustaceans, are attached to the foremost margin of the head, and project freely in front of it, admitting of being moved horizontally one towards the other, like a pair of forceps" (p. 88). The larvæ (Praniza) are even more insect-like in appearance than the adult forms (see Plate 8, Figs. 13 and 27). The females of these forms are probably parasitic upon deep-sea fishes, or other large deep-sea animals. The males and larvæ of three species described were dredged from 72° to 78° N. lat., in from 658 to 1215 fathoms; they are all blind forms.

Many beautiful forms of *Arcturidæ*, *e.g.* *Arcturus baffini*, *A. tuberosus*, *A. hystrix*, &c., are figured and described. *A. baffini* was taken as far north as the west coast of Spitzbergen in 416 fathoms, and *Glyptonotus megalurus*, an allied form ranging from 63° to 78° N. latitude, inhabits depths of from 1081 to 1710 fathoms in ice-cold water!

Another strange form is the *Eurycope gigantea*. In this isopod the 2nd pair of antennæ are prodigiously developed, being more than four times the length of the whole body.

The *Amphipoda*, 45 in number, form by far the largest group of Crustacea obtained by the Expedition.

Harpinia abyssi (G. O. Sars, Pl. 13, Fig. 5) was obtained from a depth of from 350 to 2215 fathoms! It is distributed from 63° to 75° N. latitude and from 16° E. long. to 12° W. long. *Epimeria loricata*, a very handsome form, with spinose segments (Pl. 14, Fig. 2) was dredged near Spitzbergen in 260 fathoms. *Oidiceros macrocheir* dredged off Jan Mayen in 1004 fathoms was destitute of eyes (Pl. 15, Fig. 4). *Melita pallida*, another blind form (Pl. 15, Fig. 1), was found inhabiting deserted *Teredo*-burrows in an old piece of wood, dredged up from a depth of 1333 fathoms off the west coast of Spitzbergen.

Several *Caprellæ*, attached to hydroid polyps, were brought up in the dredge from a rocky bottom at 180 fathoms.

Eucheta norvegica, a copepod of the family *Calanidæ* was taken at no fewer than twelve stations at *very considerable* depths, whereas the surface-net at these localities, even when sunk considerably below the upper layer, never contained a single example.

Of the *Cirripedia*, *Scalpellum strömii* was dredged in 870 fathoms attached to the tubes of *Tubularia indivisa*. Five other species were obtained, namely, *S. cornutum*, *S. hamatum*, *S. vulgare*, *S. angustum*, and *S. striolatum*, the last attached to sponges. These are mostly white, and were collected from numerous localities and from varying depths.

A remarkably slender tubular form of *Balanus crenatus* was met with in 21 fathoms north of Beeren Island.

A Rhizocephalon (fam. *Peltogastridæ*) named *Stylon Hymenodore* attached parasitically to the abdomen of *Hymenodora glacialis* (dredged from a depth of 1861 fathoms) completes the list of forms described.

Thirteen additional species are referred to in a supplement as noticed by other writers since the present work was handed in to the scientific editor.

One is struck by the fact that of the 82 species of crustacea obtained by Sars, at these great depths in this ice-cold area, 61 are considered to represent distinct genera! Can it be that the conditions of life are here so hard, and the struggle for existence so severe, that each individual peculiarity becomes intensified, and that not only the cold, but the *darkness* may produce considerable changes in their organisation? Absence of *colour* and absence of *sight* are the prevailing characteristics exhibited by nearly every species; whilst the loss of eyes seems to stimulate the development of all the tactile organs to supply their place, so that we find the same idiosyncrasies of structure manifested in these depths of the ocean as have been observed in the Crustacea of the American and Austrian caves, and from the dark underground waters of various parts of the world.

We should fail in our duty to the author and also to the scientific reader did we omit to point out for high commendation the admirably-prepared plates which accompany Prof. Sars' Memoir, all the details of which are most beautifully and accurately rendered.

And lastly, but by no means the least meritorious feature of the work, is the generous concession made to English and American scientific readers, by the kindness of the Swedish Government, who have caused this Memoir to be printed throughout in a double column, the left hand of every page being printed in Swedish and the right hand in English.

Much praise is also due to the editor and author for the careful manner in which the English portion of the work has been passed through the press, and for the very great care bestowed on its translation from the original Swedish.

CHARLES DARWIN

Charles Darwin. By Grant Allen. "English Worthies," Edited by Andrew Lang. (London: Longmans, Green, and Co., 1885.)

Charles Darwin, und sein Verhältniss zu Deutschland. Von Dr. Ernst Kraus. Darwinistiche Schriften, Nr. 16. (Leipzig: Ernst Günther, 1885.)

IT is a curious illustration of the change which has passed over the English mind, that already the name of Darwin should head the list of a projected series of popular books, not on eminent men of science, but on "English Worthies." This first member of the series is, as might have been expected from its authorship, a pleasing and favourable specimen of a kind of literature for which the public appear to entertain so keen a relish. For it is not only clear and picturesque in style, but is also evidently written *con amore.* Indeed, it was impossible for any man of common sense or common sensibility to have come into any kind of relation with Mr. Darwin, without being stirred by feelings of hero-worship, and Mr. Allen's reverential love for the hero is a natural tribute fittingly rendered to the lofty nature and mighty influence for whose loss the universal grief is still so fresh.

As a biographical sketch the little volume is decidedly a success. It gives in brief compass and good language the history of Mr. Darwin's antecedents, of his life and work, of his relation to contemporary thinkers, and of his presumable influence upon subsequent thought. All of which is done without losing sight of the desirability, in a popular treatise, of upholding the element of romance—a kind of treatment to which the character, the life, and the work of Darwin unite in lending themselves, as it were, by nature.

In his review of the course of thought upon the theory of evolution prior to Darwin, Mr. Allen is judicious; and his speculations upon the probable position of this theory at the present time if Darwin had not lived, are interesting—tending, as they do, to show how indispensable was the work of the great naturalist in focusing the facts and showing the method. Or, to quote a somewhat happy metaphor of his own, "Darwin was not, as most people falsely imagine, the Moses of evolutionism, the prime mover in the biological revolution; he was the Joshua who led the world of thinkers and workers into full fruition of that promised land which earlier investigators had but dimly descried from the Pisgah-top of conjectural speculation."

Almost the only criticisms we have to advance relate to matters of opinion. Thus, for instance, the following passage seems to us absurd:—"Strange to say, the abortive theory [of Pangenesis] appeared some years later than Herbert Spencer's magnificent all-sided conception of 'Physiological Units,' put forth to meet the self-same difficulty. But while Darwin's hypothesis is rudely materialistic, Herbert Spencer's is built up by an acute and subtle analytical perception of all the analogous facts in universal nature. It is a singular instance of a crude and essentially unphilosophic conception endeavouring to replace a finished and delicate philosophical idea." Now we can very well understand any one who has read both the theories including them in the same condemnation, as too highly speculative, devoid of verification, and so forth. But we cannot understand any one thus exalting the one to the disparagement of the other—and least of all so on the ground that Darwin's version is "rudely materialistic." Where can there be room for any other element than the "materialistic" in the case of an hypothesis which has to do with facts purely physiological? The objection to Spencer's version we have always taken to consist precisely in its "acute and subtle perception of all the analogous facts in universal nature," whereby we are gradually translated beyond the world of physiology altogether, until we may exclaim with St. Paul—"Whether I am in the body or out of the body I cannot tell."

And this leads us to a second criticism of a more general nature. Mr. Allen, we think, is too fond of comparing the work of Darwin and Spencer, and when doing so appears to us to attach an altogether undue merit to what he calls the "deductive" as distinguished from the "inductive" method. The work of these two great Englishmen is so unlike that, even though it has been expended upon the same subject-matter, it always seems to us a great mistake to compare them; we might almost as well seek to compare the work of an historian with that of a poet. "What an ex-tra-or-dinary wealth of thought that man has," was once observed to the present writer by Mr. Darwin: "when I first read his 'Principles of Biology' I was speechless with admiration; but on reading it again I felt in almost every chapter—Why, there is here at least ten years' work for verification." Now this is surely a sound judgment, and one, moreover, in no way disparaging to the genius of Mr. Spencer. But if it is a sound judgment, surely also it shows the mistake of comparing his genius with that of the man who wrote the passage more than once quoted by Mr. Allen—"After five years' work I allowed myself to speculate on the subject."

Again, with reference to the relative values in biology of the deductive and inductive methods, Mr. Allen appears to us behind the age. To quote only one passage, he says:—"The English intelligence in particular shows itself as a rule congenitally incapable of appreciating the superior logical certitude of the deductive method. Englishmen will not even believe that the square on the hypotenuse is equal to the squares on the containing sides until they have measured and weighed, as well as they are able by rude experimental devices, a few selected pieces of rudely shaped rectangular paper." Now, it is easy to sustain the doctrine here implicated with examples drawn from Euclid; but biology is not mathematics, and if any one truth more than another is necessarily and forcibly brought home to the intelligence